# A PRELIMINARY SURVEY OF THE ZOOPLANKTON AND BENTHOS OF AN ARCTIC LAKE NEAR PRUDHOE BAY, ALASKA[1]

David Nyquist[2]
and
Jacqueline D. LaPerriere[3]

## INTRODUCTION

A North Slope lake was chosen for comparison in a study of lead contamination of lentic waters near Fairbanks, Alaska (Nyquist, Casper and LaPerriere, 1972). Water, plant, zooplankton, and bottom sediment samples were collected according to the routine established for the lead study. The zooplankton collected and the benthos picked from the bottom sediment samples are the focus of this paper.

The intensive study of freshwater benthos is just beginning in Arctic Alaska. In the summer of 1971, substantial work was begun on an arctic pond and lake under the International Biological Program. Earlier studies in Arctic Alaska that report anything related to benthic organisms merely report the capture of imago forms. The expeditions of the late nineteenth and early twentieth centuries (Ashmead *et al.*, 1910), and the work of Weber (Weber, 1948, 1949, 1950, and 1954) concentrated on the collection of terrestrial arthropods. Weber did include a section in his survey paper (Weber, 1950) on the relations of insects with fishes which indirectly refers to the arctic benthos. However, the general information, other than the lists of arthropods captured, has been severely criticized by Sailer (Sailer, 1951).

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[1]Accepted for publication: September 22, 1972

[2]Director, Environmental Sciences Study Program, Desert Research Institute, University of Nevada System, 4582 Maryland Parkway S., Las Vegas, Nevada 89109.

[3]Institute of Water Resources, Box 95103, University of Alaska, Fairbanks, Alaksa 99701.

## DESCRIPTION OF AREA

The lake (Figure 1) chosen was on the North Slope near Prudhoe Bay, located at latitude 70° 15' 30", longitude 148° 35' at an elevation of 8.81 meters above sea level. The lake was 70% ice-covered on September 16, 1971, the date it was sampled. It is approximately .70 kilometers long and .45 kilometers wide. The maximum depth is 1.21 meters and the average depth is 0.91 meters. On August 31, 1971, the permafrost depth below the surface was approximately 50.8 centimeters on land adjacent to the sampling sites.

The land area surrounding the lake is bordered along its western edge by a gentle, almost flat, slope with a 0.45 meter bank at the shore. The eastern edge of the lake is extremely flat and possibly slopes away, draining the lake.

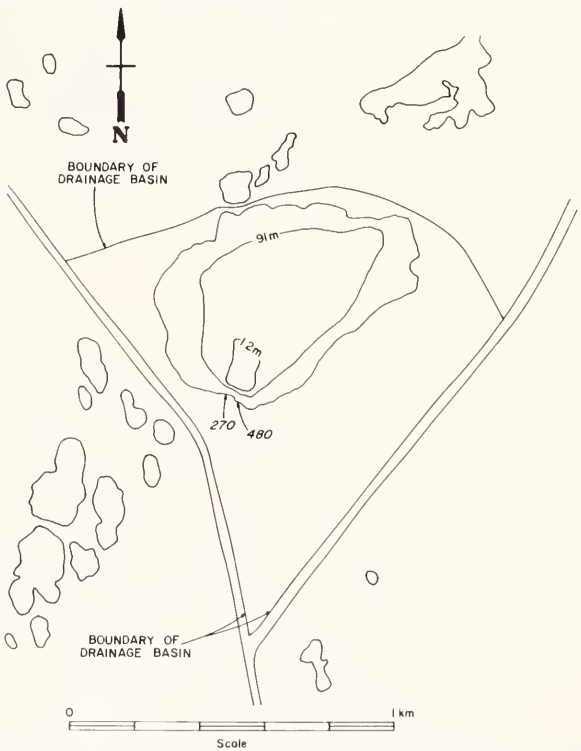


Figure 1. Morphometry of study lake located near Prudhoe Bay, Alaska.

The drainage basin encompassing the lake is $6.21 \times 10^5$ square meters or 153.5 acres. The lake surface area is $2.28 \times 10^5$ square meters (56.5 acres). The total land area in the drainage basin is $3.92 \times 10^5$ square meters.

## MATERIALS AND METHODS

The zooplankton was sampled near the surface and near the bottom with a five-liter Van Dorn bottle. The plankton was separated with a 20-mesh stainless steel screen (0.076 mm) and preserved in plastic bags with a 5% buffered formalin solution. Three bottom grabs were made with a standard 15.24 cm square Ekman dredge from an inflatable rubber raft approximately 60 meters off Station 270 at the 1.21 meter depth, and six additional bottom grabs were taken 3 meters from shore between Stations 270 and 480 at a depth of 0.3 meters.

The samples were subdivided and the benthos was floated out in water and hand picked with forceps. The organisms were preserved in 70% ethanol.

The chironomids were prepared for identification by clearing the severed heads for 20 minutes in warm 5% KOH, washing with water, soaking for 10 minutes in absolute ethanol, soaking for 10 minutes in toluene, and mounting in Permount® under a cover glass. The photomicrographs (Figures 2, 3, 5, 6, 7, 8 and 9) were made through a Zeiss Standard microscope equipped with a beam splitter and a Zeiss Ikon camera back. The photo (Figure 4) was made with a Cannon camera with a bellows attachment.

## RESULTS

The zooplankton collected in this lake consisted of calanoid copepods, a single cyclopoid copepod, *Daphnia* sp., and *Ceratium* sp. Calnanoid copepods were the most numerous and *Ceratium* sp. the second most numerous in both zooplankton subsamples: one taken near the surface and the other just above the bottom in water 1.21 meters deep.

The diversity of the surface subsample was calculated, with a formula developed by Margalef (1956), to be 1.09, and that of the bottom subsample was calculated to be 1.00. When these subsamples were combined, a zooplankton diversity of 1.06 was

calculated. This can be compared with an average zooplankton diversity of 1.10 calculated for forty-nine subarctic lakes in the lead contamination study. This indicates low biological diversity which seems to be a characteristic of northern lakes (Gerd, 1956).

The benthic samples taken in the deeper water contained mainly chironomids of the subfamily Orthocladiinae, *Cricotopus (Paratrichocladius)* cf. *alpicola* Zett (Figure 2). One individual of the subfamily Chironominae, *Stictochironomus* cf. *rosenscholdi* (Figure 3) was also taken. All of the deep water chironomids were 5 mm or less in length.

The shallow water benthos consisted of three unidentified oligocheates, three Plecoptera (Figure 4), *Nemoura* possibly of the species *trespinosa* reported by Weber (1950) as very numerous near Point Barrow, and various chironomids.

Eight different species of chironomids were identified from these samples.

Of the subfamily Chironominae, *Paratanytarsus* sp. (Figure 5), *Stictochironomus rosenscholdi* (Figure 3), *Stictochironomus histrio* type (Figure 6), and *Cryptochironomus* (Figure 7), were identified. Of the subfamily Orthocladiinae, again Cricotopus *(Paratrichocladius)* cf. *apicola* Zett (Figure 2) was the only representative. The subfamily Tanypodinae was represented by *Procladius (Psilotanypus)* sp. (Figure 8) and by another species of *Procladius* (Figure 9) which could not be further identified.

**Figure 2.** **Labial plate of *Cricotopus (Paratrichocladius)* cf. *alpicola* Zett.**

Figure 3. Antenna of *Stictochironomus rosenscholdi.*

Figure 4. *Nemoura* sp.

Figure 5. Labial plate of *Paratanytarsus* sp.

Figure 6. Head capsule of *Stictochironomus histrio* type.

Figure 7. Oblique lateral teeth of labial plate of *Cryptochironomus* sp. *(Psilotanypus)* sp.

Figure 8. Head capsule of *Procladius*

Figure 9. Lingua of *Procladius* sp.

## DISCUSSION

The work of Weber (1950) and, more recently, of the U. S. Tundra Biome Program has pointed out the importance of aquatic diptera, caddisflies, and stoneflies as well as zooplankton in the diet of arctic fish.

Bierle (1972) of the U. S. Tundra Biome Program found the benthos of arctic ponds and an arctic lake to consist primarily of oligocheates and Dipterans with a few representatives of the orders Plecoptera and Trichoptera as well as a few Turbellarians. More extensive sampling of the lake of our study would probably also yield Trichopterans.

Weber (1950) does report the sighting of mayflies (*Baetis* sp.) as far north as Anaktuvuk Pass in the Brooks Range, but larval forms have not been reported in the benthos of any Alaskan Arctic lakes. Burk, in personal communication to Weber (1950), speculated that perhaps in the Arctic these insects spend most of the time in the egg stage with extremely short nymphal, subimago, and imago stages. This possibility indeed merits further study of the Arctic Alaskan waters since mayflies are an important component of the diet of cold water fishes in other areas.

Odonata (Dragonflies and Damselflies) also have not been taken as benthos, but have been seen hawking on the arctic plateau (Weber, 1950). Although it is true that these insects could have flown from the Yukon River drainage where they have been reported, their usual territorial behavior leads one to suspect that larval forms may be found in the Arctic with further sampling.

Much work then remains to be done on the benthos of Arctic Alaska. A serious effort along this line, at least as concerns the benthos of lakes and ponds, is presently being made by the U. S. Tundra Biome Program, which hopes to fully characterize the tundra aquatic ecosystem, but as yet much is unknown.

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**ABSTRACT.**—A single lake on the North Slope of the Brooks Range in arctic Alaska was sampled for zooplankton and benthos. The sampling was not intensive enough to quantify the benthos, but some indication of its composition was obtained.

The plankton was sampled with a five-liter Van Dorn bottle and the zooplankton separated with a 20-mesh (0.076 mm) screen. The benthos was sampled with a small (15.24 cm square) Ekman dredge.

The zooplankton consisted of calanoid copepods, a single cyclopoid copepod, *Daphnia* sp., and *Ceratium* sp. The diversity of this zooplankton was calculated to be 1.06.

The benthos consisted of oligocheates, *Nemoura* sp., *Cricotopus (Paratrichocladius)* cf. *alpicola* Zett, *Stictochironomus rosenscholdi, Paratanytarsus* sp., *Stictochironomus histrio* type, *Cryptochironomus,* and *Procladius (Psilotanypus)* sp., and an unidentified *Procladius,* sp. David Nyquist and Jacqueline LaPerriere, Institute of Water Resources, Fairbanks, Alaska.